New system propels design for the handicapped

Can a designer accommodate the diverse disabilities of millions of handicapped persons in a single product? Not easy, but the system outlined here copes with the problem through a series of matrices which allow reasonable design criteria to be established.

By Rolf A. Faste

The inclusion of disabled persons in design considerations is an issue which affects as many as 34 million Americans (23 million with activity limitations plus 11 million who are over 65). To date architecture has been the design profession most influenced because groups representing the handicapped have concentrated their efforts on access to buildings. But this issue also affects other design professions—landscape architecture, interior design, graphic design, and especially industrial design.

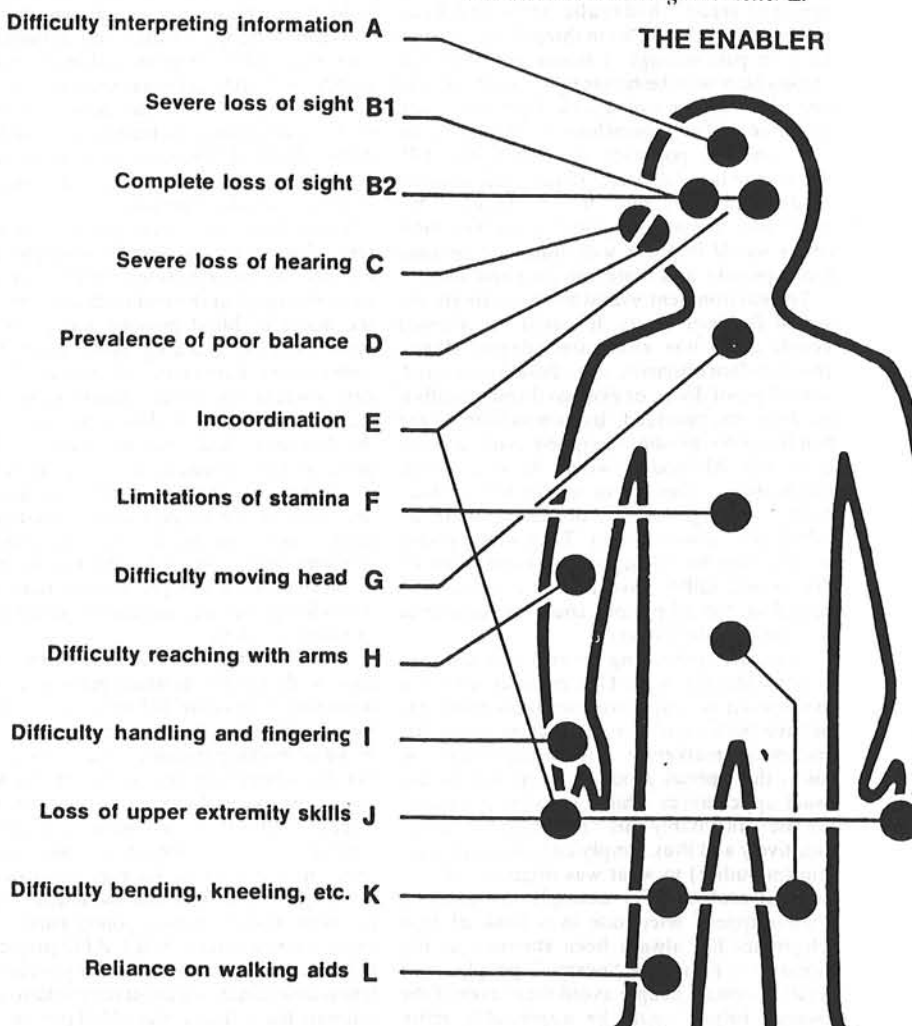
Accessibility in buildings is largely a question of proper locations and dimensions. Once architects master the principles contained in new standards and codes, it will be relatively easy to incorporate them in new construction. Their toughest job will come when incorporating these changes in renovations of older buildings. Otherwise, new buildings will perhaps cost slightly more but will look much the same.

In product design, accessibility translates into usability. Because people come into physical contact with products, the issues involved in "designing for the handicapped" will have much more effect on our work than perhaps any other profession. In fact, it is because people come into physical contact with buildings via products (doors, elevators, water fountains, and the like) that I was involved as an industrial designer from the beginning of the present work developing new standards for the American National Standards Institute (A.N.S.I.) A 117.1 program, *Making Buildings and Facilities Accessible to and Usable by the Physically Disabled.* The product standards developed cover areas such as elevators, fixtures, toilet heights, the pressure required to open doors. All federally funded buildings must meet A.N.S.I. standards which are also referred to or adopted by local building codes.

In addition to HUD, sponsors for the project, originally contracted to Syracuse University School of Architecture, are the Easter Seals Society and the President's Committee for the Employment of the Handicapped.

Groups from the building industry and building regulatory bodies, as well as professional designers and members of societies for the handicapped, will vote individually on each line of the proposed standards with a majority vote prevailing.

A copy of the proposed standards can be obtained from Edward Steinfeld, project director, Department of Architecture, Syracuse University, 118 Clarendon St., Syracuse, NY, 13210, for $12.50 prepaid. Though these standards do not presently include the research procedure used in the A.N.S.I. program, the procedure will be outlined in this article with charts and matrices. They were developed to indicate the motor and perceptual skills caused by various handicaps, and the relationships between



The Enabler is an ideogram representing a person's abilities as a basis for design. The chart illustrates the different areas of disability concern in a logical order from top to bottom: mental functioning, the senses and motion impairment. It can be used in conjunction with all other charts appearing on the following pages to which it has been keyed.

As an aid to understanding, we have pinpointed three areas of disability concern so the reader can follow the development process from chart to chart: prevalence of poor balance—letter D; difficulty in handling and fingering—letter I; and reliance on walking aids—letter L.

handicaps—which can result in overlapping or conflicting environmental design requirements. The research procedure will become obtainable, however, in approximately six months from the U.S. Printing Office, as part of the total project report.

Understanding the problem

The product most associated with disabled persons is the wheelchair. In order to illustrate the problems involved in "designing for the disabled," let us imagine this product developed to its logical but ridiculous conclusion: a Buck Rogers wheelchair with myoelectric control, armored treads, hydraulic arms and laser torches for cutting holes in things large enough for it to pass through. Undoubtedly, the first prototypes would be rather ugly and crude, and only the wealthiest of disabled persons could afford one. The wheelchair would rarely be seen, and the populace at large would talk about "the laser-chaired" in the same condescending way they refer to "the blind," "the deaf" and "the handicapped." However, laser chairs would improve with time and become less expensive and more compact and sleek.

The environment would be increasingly designed for laser chairs. It would be assumed people could now climb sixty degree slopes, cross ten-foot obstacles, open thousand-pound, vandal-proof doors, or even go through walls if no door was provided. By comparison to the handicapped person equipped with a laser chair, the able-bodied would be at a serious disadvantage. This is not unlike the predicament disabled people find themselves in, in the world as we know it today. They would prefer to have very little designed for them. Instead, they would rather have the environment designed so that all persons could participate in it—including themselves.

There are compelling reasons why disabled persons feel this way. One obvious reason is that special products are inevitably more expensive because of low production quantities and special marketing. A more important reason is that special products often lead to unusual appearances which, in turn, stigmatize the user. Inevitably this "branding" is valued negatively and thus, simply adds a social problem (prejudice) to what was originally only a physical problem. For example, the lowered "handicapped" telephone in a bank of high telephones has always been shunned as obviously not meant for "normal" people. As a result "normal" people avoid them even if the lowered height would be appreciably more convenient.

While it is true they may have a disability, it is the built environment which presently handicaps disabled persons in much the same way as the laser chairs would handicap able-bodied persons. There is no reason why disabled persons cannot use a toilet, for example, if they can get to it. There is no basic reason why they cannot open a door, if the locking device has been designed so that it can be grasped and the door opened without excessive force. And there is no reason why they cannot use a freezer compartment in a refrigerator, if they can reach it. In this case, extendable grippers to reach high freezer shelves is an example of a solution intended to eliminate a built-in handicap. Instead of designing for disabled persons, we should design so that disabled persons can use the environment and the objects in it. This holds true in related areas of design advocacy.

We must design for the limits of human performance which are generated by the extremes in size, strength, stamina, sensory perception and intelligence. With the possible exception of the seven foot basketball player and the 280 pound football lineman, these extremes will certainly be found among young, old, able-bodied or disabled persons.

There will be design compromises of course. One obscure but important example uncovered by our research (reference charts and matrices excerpted at the end of this article) is that the needs of blind persons and people who have difficulty walking often conflict. The former need more tactile information from the environment, the latter require support. For example, blind persons like to be warned about the beginning and end of stairways. Newel posts which terminate handrails at landings provide such information, but persons requiring handrails for support often cannot get past them. Conversely, blind persons can easily collide with many types of handrails and supports. In short, things which provide assistance to one disability group may in actuality be an impediment to another.

There will also be instances where we will have to design for disabled persons. It is economically unfeasible, for instance, to make all toilets accessible to wheelchair users, or to make all parking spaces twelve feet wide to allow for wheelchair access. But on the whole, designing with disabled persons in mind, rather than for them, will prove to be the more economical and advantageous route to an environment that is easier for everyone to use.

Designers may feel that too much emphasis has been placed on these points. However, my experiences on the A.N.S.I. A117 project confirmed, again and again, that the primary problem is attitudinal. We constantly tend to underestimate the abilities of disabled persons. After all, disabled people are only disabled in terms of their specific impairment. By referring to disabled persons, rather than "the handicapped," we can focus on the real problem—counteracting the effect of impairments.

This chart describes the specific chronic conditions and impairments, however dissimiliar, which may result in the same physical or perceptual disability. The list reproduced here details the different conditions contributing to disabilities corresponding to letters D, I and L. It has been excerpted from a larger list which includes disabilities corresponding to letters A through N keyed to all charts.

Chronic conditions and impairments

D. Prevalence of poor balance
- abnormally high/low blood pressure
- some hemiplegics
- paraplegics
- amputees
- multiple sclerosis
- muscular dystrophy
- cerebral palsy
- Parkinson's disease
- brain tumors
- dystonia musculorum deformans and other central nervous system disorders
- Meniere's disease

I. Difficulty in handling & fingering
- quadriplegia, partial or incomplete—polio, spinal cord disorders, brain tumors
- bilateral hemiparetic
- amputation of one or two fingers
- arthritis
- cerebral palsy
- severe burns
- neurological disorders—multiple sclerosis, Parkinson's disease, syringomyelia, myesthemia gravis, polymyositis, neuropathies
- heart disease (shoulder-hand syndrome)
- congenital defects-webbed fingers, accessory bones
- Dupuytren's contracture
- Temporary conditions
- traumatic injuries to arms or hands (nerve damage, compound fractures)

L. Reliance on walking aids
- paraplegics
- hemiplegics
- cerebral palsy
- multiple sclerosis
- muscular dystrophy
- hemophilia
- brain tumors (affecting lower extremity)
- spinal cord tumors
- spina bifida
- neuropathies
- lower extremity amputees
- arthritis
- poor balance
- painful lower extremity-cancer
- Temporary conditions
- traumatic injuries—fractures, sprains, strains
- severe lacerations
- cysts
- inflammation

The design Matrices relate specific handicaps to the perceptual or physical behavior required by the movements and awarenesses related to specific design situations, in this case activating controls. A similiar matrix on the following page deals with the ability to receive information and read displays. Again the letters D, I and L have been especially noted.

How to include the needs of disabled persons in the design process

Few would argue with the theory that standard, not special, products should be developed to accommodate the handicapped. In the past, however, no formal research system existed to implement this philosophy. A new procedure in the form of charts and matrices allows the designer to group and/or isolate physical and perceptual disabilities resulting from a variety of handicaps, so that reasonable design criteria can be established.

Despite the great number of diseases and chronic conditions, there is a manageable number of dysfunctions which result from them. To illustrate these disability concerns, an ideogram was created, called The Enabler, which illustrates the different areas of disability concerns in a logical order from top to bottom: mental functioning, the senses and motion impairment. The Enabler is intended to help designers visualize the various disability concerns. The chronic conditions and impairments which give rise to these conditions may be found in the accompanying table. Group B, severe loss of sight, is split into two subgroups on the ideogram because the partially sighted and the blind often have diametrically opposed needs from a design standpoint. The former makes the greatest demands on graphic presentations, the latter makes no visual demands.

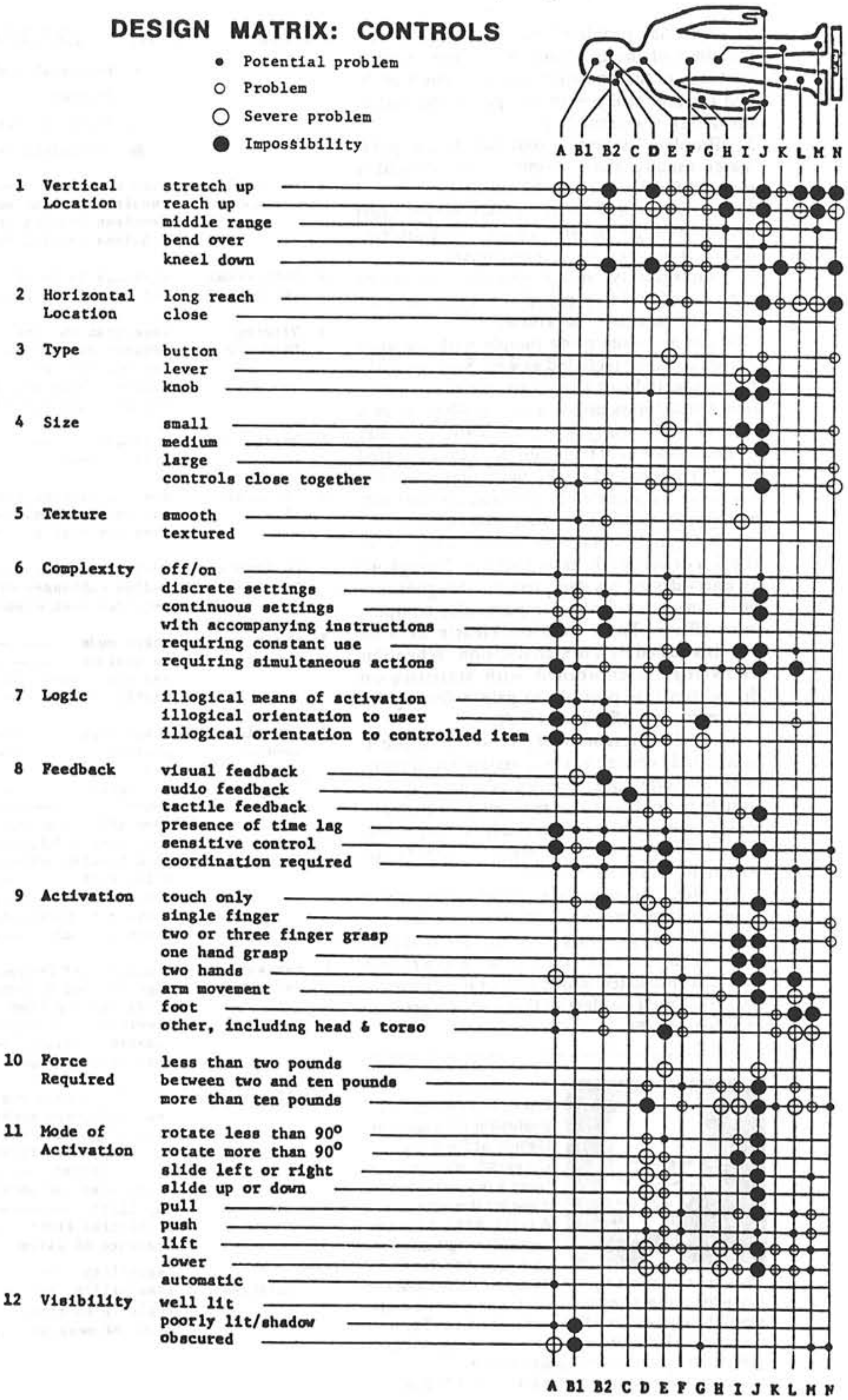
Many disabilities are interrelated. Some disability concerns share the same cause. For example, cerebral palsy can cause mental retardation and restrict use of legs. Other disability concerns have secondary effects. Persons using crutches, for example, are preoccupied with the ground ahead of them and have difficulty looking up. The only disability which has little interaction with the others is blindness. The interrelationships between disability concerns are illustrated in the interaction matrix.

One of the more interesting observations gleened from this matrix is the number of disabilities associated with poor balance. The prevalence of this dysfunction has an impact on all products which require manipulation or an application of force.

Design matrices can relate the above disability information to specific design situations. Four such matrices appear particularly useful: one for information displays (graphics and signage), controls (mechanical and electrical), storage (including work surfaces), and assists (handrails, grab bars, etc.). Each point on a matrix is an interface between one design parameter and one of the disabilities represented by The Enabler. Each intersection has five possible outcomes:

1. "No problem" indicates there is no relationship between the design parameter and a particular disability.

DESIGN MATRIX: CONTROLS



2. "Potential problem" indicates that a few members of the disability group may have a problem, or that there is not necessarily a problem for that group with this parameter unless the design is extremely poor.
3. "Problem" indicates that the design parameter usually gives people in the disability group difficulty that can be overcome.
4. "A severe problem" exists when most people in the group cannot overcome problems arising from that design parameter.
5. "Impossibility" means just that. No member of the disability group can use a product with that particular parameter.

A group representing people with no disabilities could be included as well. Such an addition would indicate that all people have a problem when, for example, a sign is illegible or a control is illogically activated. Thus, it should be understood that the problem areas indicated are only intensified by the particular disability involved. As is often not the case, the matrices assume no interaction among parameters.

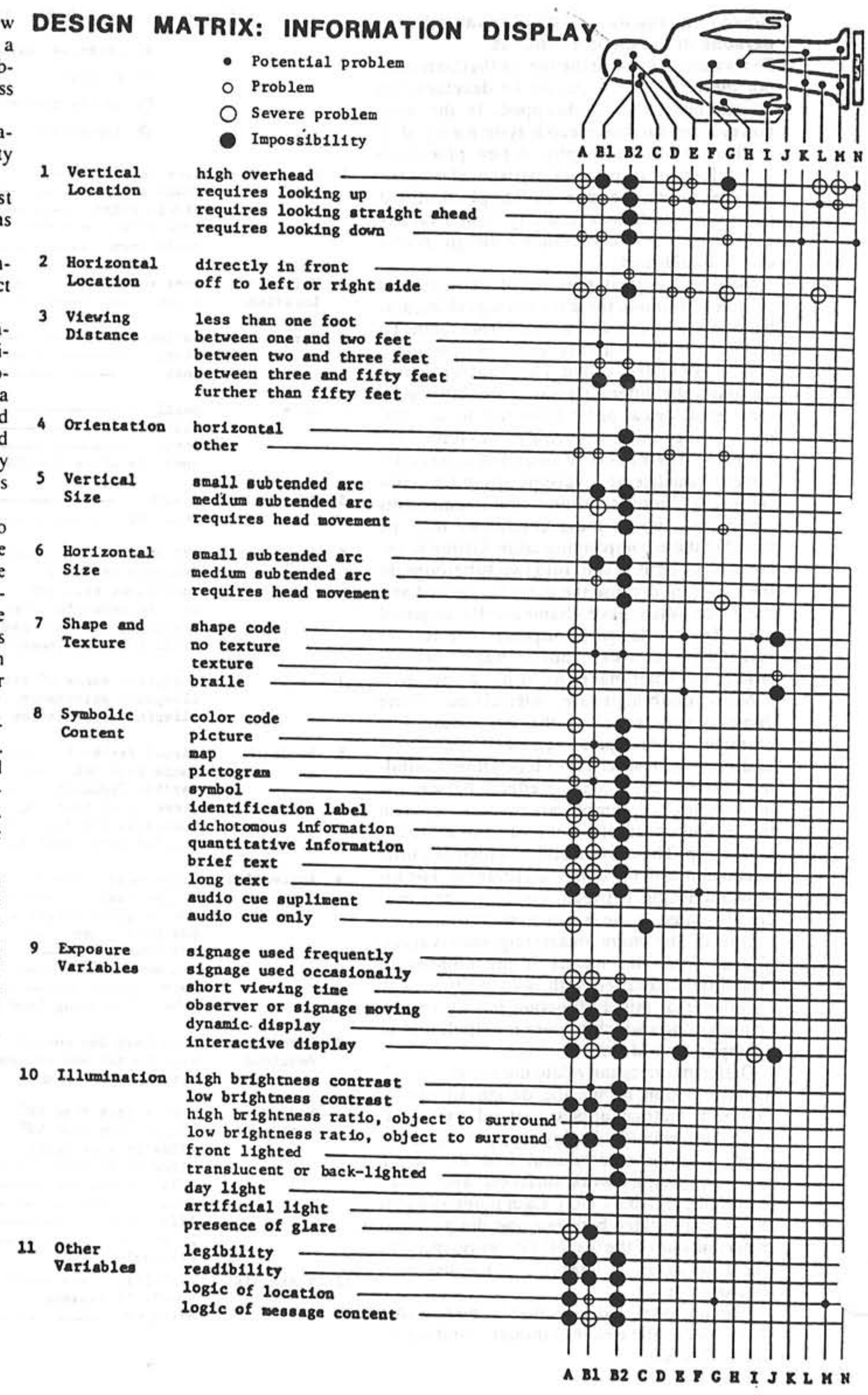
The designer may use these matrices to check a design while he is working. Though we all know design is a compromise, designers are often unaware of whom a particular compromise affects. These matrices clearly indicate who is affected by a design decision. When this knowledge is combined with statistics on disabilities it is possible to gain a feeling for how many are affected as well.

Some designers may object to the imprecision found between various design parameters, as in the difference between reaching up and stretching up. It must be remembered that disability concerns are themselves imprecise. Therefore, it makes little sense to qualify the parameters more accurately.

The interaction matrices clearly show which design parameters cause problems for the disabled. If these particular matrices are inappropriate for a particular job, a new design matrix may be constructed which relates the disability concerns (the Enabler) to that specific product or situation. ID

The author, Rolf A. Faste, is an associate professor of Industrial Design at Syracuse University and has been a research associate for the new A.N.S.I. A117.1 Standards, *Making Building and Facilities Accessible to and Usable by the Physically Disabled*, since the project began in 1974. Faste holds engineering degrees from Stevens Institute of Technology and Tufts University, an architecture degree from Syracuse University, and is a professional engineer and member of I.D.S.A.

DESIGN MATRIX: INFORMATION DISPLAY

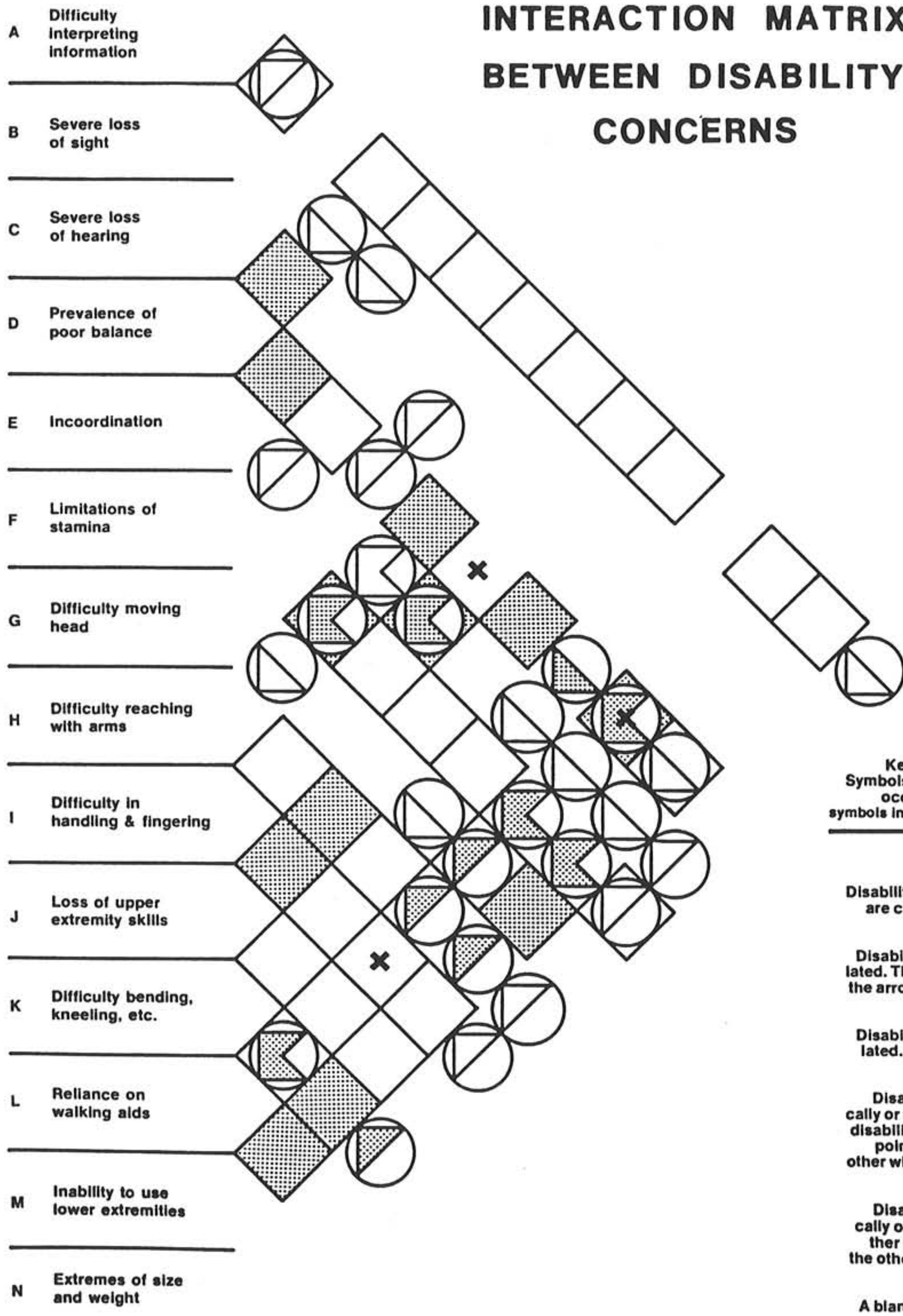


The Interaction Matrix allows us to see relationships between separate sets of disabilities, caused by a variety of different handicaps. Designers can then develop the kind of design criteria which will accommodate the greatest number of handicapped people. For example, disabilities resulting from a prevalence of poor balance, letter D, and disabilities resulting from a reliance on walking aids, Letter L, are frequently medically related (caused by the same chronic disease). In addition, they can be frequently non-medically related, with one disability giving rise to the other. In this example either disability can cause the other.

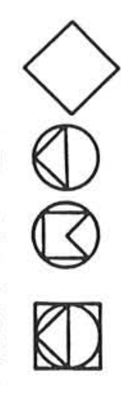
Disabilities resulting from a reliance on walking aids, letter L, are occasionally medically related to disabilities resulting from a difficulty in handling or fingering, letter I.

Disabilities resulting from a difficulty in handling or fingering, letter I, are not related to disabilities resulting from a prevalence of poor balance, letter D.

INTERACTION MATRIX BETWEEN DISABILITY CONCERNS



Key for the Interaction Matrix
Symbols appearing in line indicate occasional relationship, solid symbols indicate frequent relationship.



Disabilities share medical cause—are caused by the same chronic disease.

Disabilities are non-medically related. The disability towards which the arrow points is the one caused by the other.

Disabilities are non-medically related. Either disability can cause the other.

Disabilities can be either medically or non-medically related. The disability towards which the arrow points is the one caused by the other when they are non-medically related.

Disabilities can be either medically or non-medically related. Either disability can be caused by the other when they are non-medically related.

A blank indicates no relationship between disabilities.